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㉓ Two-component flow improver additive for middle distillate fuel oils:

㉔ Distillate fuels, particularly those having a relatively high final boiling point, are significantly improved in their flow and filterability properties utilising a two component additive consisting of 25 to 95 wt.% preferably 50 to 90 wt.% of, C<sub>30</sub>-C<sub>40</sub> oil-soluble nitrogen compound being an amide or amine salt of an aromatic or cycloaliphatic carboxylic acid and 75 to 5 wt.% preferably 10 to 50 wt.% of a certain category of ethylene-vinyl acetate copolymers.

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TWO-COMPONENT FLOW IMPROVER ADDITIVE  
FOR MIDDLE DISTILLATE FUEL OILS

1 This invention relates to the use of certain mixtures of  
additives to improve the flow and filterability properties  
of distillate fuels at low temperatures to fuels containing  
the mixtures and to concentrates of the additives for  
5 incorporation into the fuel.

particularly, the invention relates to an additive system  
composed of a nitrogen-containing wax crystal growth inhibitor  
and a particular category of ethylene-vinyl acetate copolymer.

10 Various additives are disclosed in the art for improving the  
flow properties of middle distillate fuel oils. Combinations  
of additives which function both as wax nucleators and/or  
wax crystal growth stimulators and as wax growth arrestors  
are well-known and disclosed for example in U.S. Patent  
15 3,961,916 issued June 8th 1976 to Ilnyckyj et al, which  
shows an additive combination comprising ethylene copolymerised  
with ethylenically unsaturated mono- or dicarboxylic acid  
alkyl esters or a vinyl ester of a C<sub>1</sub>-C<sub>17</sub> saturated fatty  
acid.

20 Additive systems comprising nitrogen containing amide or  
amine salts as used in the present invention are disclosed  
in U.S. Patent 4,211,534 issued July 8th, 1980 to Feldman

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1 which discloses a three component combination additive  
flow improver consisting of an ethylene polymer or  
copolymer, a second polymer of an oil soluble ester  
and/or C<sub>3</sub> and higher olefin polymer and, as a third  
5 component, a nitrogen containing compound. This  
three component system is said to have advantages over  
combinations consisting of any two of the additive  
components for improving the cold flow properties  
of distillate fuels.

10 U.S. Patent 3,982,909, issued September 28th, 1976 to  
Hollyday discloses an additive system comprising amides,  
diamides and ammonium salts alone or in combination with  
certain hydrocarbons such as microcrystalline waxes or  
petrolatums and/or an ethylene backbone polymeric pour  
15 depressant, the combination being useful as a flow improver  
for middle distillate fuels.

20 Nitrogen containing oil soluble succinic acid or its  
derivatives are disclosed in U.S. Patent 4,147,520  
issued April 3, 1975 to Ilynckyj which describes these  
materials in combination with ethylene vinyl acetate  
copolymers wax nucleators.

25 The present invention is based on the discovery that a  
two component additive system consisting essentially of an  
amine salt that is an alkyl ammonium or amide compound  
having a total of 30-200 preferably 50-150 carbon  
atoms derived from certain carboxylic acids or

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- 1      vinyl acetate copolymer is highly effective at relatively lower treatment levels for improving the flow and filterability properties of middle distillate fuels below their cloud points.
- 5      In accordance with the present invention there have been discovered improved wax containing petroleum fuel oil compositions comprising a wax containing middle distillate fuel oil, boiling in the range of about 120°C-500°C, which has been improved in its low temperature properties by the
- 10     addition of 0.005 to 0.5 wt.%, preferably 0.005 to 0.25 wt.% of a flow and filterability improver consisting essentially of:
  - (a)     In the range of about 25 to 95 wt.% preferably 50 to 90 wt.% based on a total weight of flow improver of a C<sub>30</sub>-C<sub>300</sub> oil-soluble nitrogen compound wax crystal growth inhibitor having at least one straight C<sub>8</sub>-C<sub>40</sub> alkyl chain and being selected from the class consisting of alkyl ammonium salts and/or amides of aromatic or cycloaliphatic polycarboxylic acids or anhydrides thereof or the amides/amine salts of partial esters, e.g. monoesters of said polycarboxylic acids, e.g. dicarboxylic acids, and

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1        (b) In the range of 75-5 wt.% preferably 50-10 wt.%  
of an ethylene-vinyl acetate copolymer having a  
vinyl acetate content of about 10-40 wt.% preferably  
10-35 wt.% and a number average molecular weight  
5        ( $M_n$ ) of about 1000-30,000 e.g. 1500 to 7000  
preferably 1500 to 5500 and a degree of branching  
in the range of about 1 to 20 preferably 2-12 methyl  
groups per 100 methylene groups other than the  
acetate groups as determined by Nuclear Magnetic  
10      Resonance ( $^1H$  NMR) Spectroscopy.

The flow improver combination of the present invention  
is useful in a broad category of distillate fuels  
boiling in the range of about 120°C to about 500°C  
(ASTM D1160), preferably those distillate fuels  
15      boiling in the range of about 150°C-400°C. The  
invention is especially applicable to fuels which  
have a relatively high final boiling point (FBP),  
that is, above 360°C.

20      The use of such fuels has recently become more  
extensive and these fuels tend to contain longer  
chain n-paraffins and will generally have higher  
cloud points. Generally speaking, these fuels are  
more difficult to treat effectively with conventional  
flow improver additives. The most common petroleum  
25      distillate fuels are kerosene, jet fuels, diesel

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1      fuels and heating oils. Low temperature flow properties  
are most usually encountered with diesel fuels and  
with heating oils.

5      While fuel treatment rates in excess of 0.25 wt.% may  
be used, such as up to about 0.5 wt.%, excellent  
results are usually achieved within the aforesaid  
range of 0.005 to 0.25 wt.% and preferred in the  
range of about 0.005 to 0.05 wt.% based upon the  
weight of distillate fuel.

10     The nitrogen containing wax crystal growth inhibitors  
used in the present invention are generally those  
having a total of 30-300, preferably 50-150 carbon  
atoms and being those oil-soluble amine salts and  
amides formed by reacting at least 1 molar portion of  
15     a hydrocarbyl substituted amine with 1 molar portion  
of the aromatic or cycloaliphatic polycarboxylic  
acid, e.g. 2 to 4 carboxyl groups preferably dicarboxylic  
acids, or their anhydrides or partial esters of  
dicarboxylic e.g. mono-esters of dicarboxylic acids.

20     The amines may be primary, secondary, tertiary or  
quaternary, but preferably are secondary. Tertiary  
and quaternary amines can only form amine salts.  
Examples of amines include tetradecyl amine, cocoamine,  
hydrogenated tallow amine and the like. Examples of  
25     secondary amines include cocomethyl amine, dioctadecyl

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1       amine, methyl-benhenyl amine and the like. Amine  
mixtures are also suitable and many amines derived  
from natural materials are mixtures. The preferred  
amine is a secondary hydrogenated tallow amine of  
5       the formula  $\text{HNR}_1\text{R}_2$  wherein  $\text{R}_1$  and  $\text{R}_2$  are  
alkyl groups derived from tallow fat composed of  
approximately 4%  $\text{C}_{14}$ , 31%  $\text{C}_{16}$ , 59%  $\text{C}_{18}$ .

10      Examples of suitable carboxylic acids (and their  
anhydrides) include cyclohexane dicarboxylic acid,  
cyclohexene dicarboxylic acid, cyclopentane dicarboxylic  
acid, naphthalene dicarboxylic acid, and the like.  
Generally these acids will have about 5-13 carbon  
atoms in the cyclic moiety. Preferred acids useful  
in the present invention are benzene dicarboxylic  
15      acids such as phthalic acid, terephthalic acid, and  
isophthalic acid. Isophthalic acid or its anhydride  
is the particularly preferred embodiment.

20      It is preferred that the nitrogen containing compound  
has at least one straight chain alkyl segment extending  
from the compound containing 8-40 preferably 14-24  
carbon atoms. Preferably the nitrogen compound  
contains at least three alkyl chains each containing  
from 8 to 40 carbon atoms and preferably at least two  
of these chains are normal. Also at least one ammonium

1 salt, amine salt or amide linkage is required to be  
present in the molecule. The particularly preferred  
amine compound is the amide-amine salt formed by  
reacting 1 molar portion of phthalic anhydride with 2  
5 molar portions of di-hydrogentated tallow amine.  
Another preferred embodiment is the diamide formed by  
dehydrating this amide-amine salt.

10 Also suitable are the amide or amine salts of monoesters  
of the aforesaid dicarboxylic acids, the alkyl chain  
of the ester containing about 8 to 40 carbon atoms.  
15 But lower alkyl monoesters may also be suitable  
provided the nitrogen compound is an oil-soluble  
compound and has about 30-300 preferably 50-150  
carbon atoms. An octadecyl ester of an amine salt of  
phthalic anhydride is an example of a preferred  
embodiment in this category.

20 In this invention both the type of nitrogen-containing  
compounds and the type of ethylene vinyl acetate  
copolymer used have been found to be significant  
parameters to provide an effective two-component  
additive system which is a superior flow improver.  
Thus, for example, it has been found that the flow  
improver combination of the present invention is a  
highly effective one compared with three-component  
25 systems such as disclosed in U.S. Patent 4,211,534

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1 which are used at relatively high treatment concentrations. It has been found in the present invention that the use of a third component with its associated costs may not be necessary in many fuels.

5 It is believed that the nitrogen containing compounds of the present invention are highly effective in inhibiting the growth of wax crystals. Typically as a distillate fuel cools normal alkanes containing from about 14 to 32 carbon atoms crystallise out, the  
10 longer alkanes crystallising first, generally the maximum is at around 20 to 22 carbon atoms. The nitrogen containing compounds appear to be highly effective in controlling the growth of the bulk of the alkane waxes but appear to be slightly less  
15 effective in controlling the initial stages of wax precipitation.

Although the optimum polymer properties will vary from one fuel to another, we prefer that the ethylene vinyl acetate copolymer contain from 10 to 40 wt.% more preferably 10 to 35 wt.%, most preferably from 20 10 to 20 wt.% vinyl acetate; has a number average

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1 molecular weight ( $M_n$ ) as measured by Vapour Phase  
Osmometry within the range of about 1,000 to 30,000,  
preferably 1500 to 7000 more preferably 1500 to 5500  
most preferably of 2500 to 5500 and a degree of  
5 branching in the range of 1 to 20 preferably 2 to 12.  
The degree of branching is the number of methyl  
groups other than those of the vinyl acetate in the  
polymer molecule per 100 methylene groups as determined  
by proton nuclear magnetic resonance spectroscopy as  
10 for example using a Perkin-Elmer R-34 Spectrometer on  
20% (W/W) solution in orthodichlorobenzene at 100 °C  
operating at 220 MHz in the continuous wave mode.

Whilst the polymer branching may vary within these  
limits we have found that the more important character-  
istic of the copolymer is the vinyl acetate content.  
15 We have found that the use of ethylene vinyl acetate  
co-polymers of different solubility characteristics  
due to a polymer structure especially a vinyl acetate  
content outside that described above can result in a  
20 fuel having adverse flow and filterability performance.

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1       we have also found that the relative proportions of  
the nitrogen containing compound and the ethylene  
vinyl acetate copolymer is important in achieving the  
improvement in flow and filterability. We have found  
5       that, based on the total weight of additive in the  
fuel, at least 25 wt.% preferably at least 50 wt.% of  
the nitrogen containing compound should be used and  
more preferably between 25 and 95 wt.% preferably 50  
to 95 wt.% most preferably between 60 and 90 wt.%,  
10       especially between 60 and 80 wt.% the balance  
being the ethylene/vinyl acetate copolymer.

The additive systems of the present invention may  
conveniently be supplied as concentrates of the  
mixture of the nitrogen containing compound and the  
15       ethylene vinyl acetate copolymer in oil or other  
suitable inert solvent for incorporation into the  
bulk distillate fuel. These concentrates may also  
contain other additives as required. These concentrates  
which contain from 3 to 90 wt.% preferably from 3 to  
20       60 wt.%, more preferably 10 to 50 wt.% of the

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1       additives in oil or other solvent are also within the  
scope of the present invention.

5       The invention is further illustrated by the following  
examples which are not to be considered as limitative  
of its scope. In these Examples unless specified  
otherwise reference to parts is parts by weight.

10      In the Examples 1 to 11 below the fuel has been  
evaluated according to the Distillate Operability Test  
(DOT test) which is a slow cooling test shown to be  
reasonably accurate compared with actual field conditions.

DOT Test

15      Flow Improved Distillate Operability Test (DOT test)  
is a slow cooling test designed to correlate  
with the pumping of a stored heating oil. The cold  
flow properties of the described fuels containing the  
additives were determined by the slow cool flow test  
as follows. 300 ml of fuel are cooled linearly at 1°C/hour  
to the test temperature then that temperature is held  
constant. After 2 hours at the test temperature, approx-  
20      imately 20 ml of the surface layer is removed by suction  
to prevent the test being influenced by the abnormally  
large wax crystals which tend to form on the oil/air  
interface during cooling. Wax which has settled

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1 in the bottle is dispersed by gentle stirring, then a CFPP  
filter assembly as described hereafter in relation to CFPP  
Test is inserted. A vacuum of 300 mm of water is applied  
and 200 ml of the fuel is passed through the filter into the  
5 graduated receiver, A PASS is recorded if the 200 ml are  
collected within sixty seconds through a given mesh size or  
a FAIL if the filter becomes blocked and the flow rate is  
too slow.

10 Filter assemblies with filter screens of 20, 30, 40, 60,  
80, 100, 120, 150, 200, 250, 350 mesh number are used to  
determine the finest mesh number that a wax containing fuel  
will pass. The smaller are the wax crystals and therefore  
the finer the mesh the greater the effectiveness of the  
additive flow improver. It should be noted that no two  
15 fuels will give exactly the same test results at the same  
treatment level for the same flow improver additive, and,  
therefore, actual treat levels will vary somewhat from fuel  
to fuel.

"Nitrogen Compound A"

20 The amide/dialkyl ammonium salt from the reaction product  
of 1 mole of phthalic anhydride with 2 moles of a  
secondary di(hydrogenated tallow) amine, containing a  
mixture of tallow fat n-alkyl groups as follows: 4%  
C<sub>14</sub>, 31% C<sub>16</sub>, and 59% C<sub>18</sub>.

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1      "EVA Polymer 1"

Was an ethylene-vinyl acetate copolymer of Mn 3400 "V.P.O.", having 17.0 wt.% vinyl acetate and an 8.0 degree of branching i.e. 8 methyl terminating alkyl side chains other than vinyl acetate per 100 methylene groups.

The characteristics of the fuels used in the following Examples were

<u>Fuel</u>	<u>Distillation (ASTM D86), °C</u>					<u>Cloud</u>	<u>Wax</u>
	<u>IBP</u>	<u>20%</u>	<u>90%</u>	<u>FBP</u>	<u>Point</u>	<u>Appearance</u>	
1	182	220	354	385	+1	-2.5	
2	180	226	341	368	-3.5	-5.5	
3	188	238	344	375	-1	-4.5	

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1 Example 1

Fuel 1 was evaluated in the DOT test using a flow improver composed of 75% by weight of Nitrogen Compound A, and 25% by weight of EVA Polymer 1 and the results at -12°C are reported below:

5	<u>Concentration in Fuel</u>	<u>Finest Mesh Passed</u>
	100 ppm	80
	150 ppm	350
	200 ppm	350

10 Example 2

Example 1 was repeated but using Fuel 2 with the following results:

15	<u>Concentration in Fuel</u>	<u>Finest Mesh Passed</u>
	50 ppm	40
	150 ppm	200
	200 ppm	250

16 Example 3 - Comparison

For the purpose of comparison, the test of Example 1 was conducted with the conventional flow improver additive as reported in Example 1, polymer 1 in U.S. Patent 4,211,534. This flow improver additive is described as a polymer mixture of about 75 wt.% of a wax growth arrestor and about 25 wt.% of a nucleator, both compounds being ethylene vinyl acetate polymer, henceforth referred to as Polymer 15.

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<u>PPM of Additive</u>	<u>Finest Mesh Passed</u>	
	<u>Fuel 1</u>	<u>Fuel 2</u>
100	40	30
150	100	40
200	120	80

1 Example 4

(a) The test of Example 2 was repeated in Fuel 2 using a flow improver composed of 100 parts by weight Nitrogen Compound A and 25 parts by weight of EVA Polymer 1. 125 ppm of this was added to the fuel and the finest filter mesh passed was 200.

(b) Example 4(a) was repeated except that 25 parts of an ethylene vinyl acetate copolymer having a  $M_n$  of 2000 and a 36% vinyl acetate content was added to the composition of Example 4(a) to thereby provide a three component additive and the finest filter mesh passed was 120. This indicates the adverse results of adding components heretofore considered desirable to the two component system of this invention.

15 Example 5

The DOT test used in Example 1 was repeated using Fuel 3. All tests were at  $-12^{\circ}\text{C}$  with 100 ppm flow improver composed of 75 ppm Nitrogen Compound A of Example 1 and 25 ppm of various ethylene vinyl acetate copolymers (EVA) tabulated below. Results are in Table 1. The purpose of this example is to demonstrate the importance of the particular category of ethylene-vinyl acetate copolymers.

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TABLE 1

<u>Polymer</u>	<u>Wt.% VA</u>	<u>M<sub>n</sub></u>	<u>Branching*</u>	<u>Finest Mesh Passed</u>
2.	13.5	2750	9.1	80
3	15.8	5500	7.6	100
4	17.0	3400	8.0	150
5	27.6	6250	5.6	100
6	29.4	3050	9.1	60
7	33.0	5000	10.0	60
8	36.0	2000	4.0	60

1      \* Branching is the number of methyls per 100 methylene  
5      groups excluding the vinyl acetate methyls as measured  
by <sup>1</sup>H NMR Nuclear Magnetic Resonance spectroscopy.  
All spectra were run on a Perkin-Elmer R-34 spectrometer  
5      on 20% (w/w) solution in orthodichlorobenzene at 100°C  
operating at 220 MHz.

Example 6

The performance of an additive mixture containing 3 parts by weight of Nitrogen compound A and 1 part by weight of EVA  
10      Polymer 1 was compared at different concentrations of additive with

- (i) Polymer 15 - B
- (ii) EVA Polymer 1 on its own - C
- (iii) EVA Polymer 8 of Table 1 - D

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1 The results in the DOT test at -12°C in Fuel 1  
are shown in Figure 1 those for the composition of the  
invention being curve A, the lettering of the other curves  
correspond to the above Table.

5 Examples 7 and 8

The comparison of Example 6 was repeated in Fuels 2 and 3  
and the results are shown in Figures 2 and 3 respectively.

Example 9

10 Mixtures of different proportions of Nitrogen compound A and  
EVA Polymer 1 were prepared and tested in Fuel 1 in the DOT  
test at -12°C and treat rates of 200 and 125 ppm  
additive in the fuel. The results were compared with a  
similar additive mixture but containing EVA Polymer 8  
of Table 1. The results are shown in Figure 4, the  
15 upper curve being at 200 ppm additive treat rate, the  
lower at 125 ppm. In each curve trace E is of the  
present invention and trace F is the Composition  
containing EVA Polymer 8 of Table 1 in the place of  
EVA Polymer 1.

20 Examples 10 and 11

Example 9 was repeated but using Fuels 2 and 3 and the  
results are shown in Figures 5 and 6 respectively.

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1 In the following Examples 12 to 16 the response of the  
oil to the additives was measured by the Cold Filter  
Plugging Point Test (CFPPT) which is carried out by  
the procedure described in detail in "Journal of the  
5 Institute of Petroleum", Volume 52, Number 510, June-  
1966, pp. 173-185. This test was designed to correlate  
with the cold flow of a middle distillate in European  
automatic diesels.

10 In brief, a 40 ml sample of the oil to be tested is  
cooled in a bath which is maintained at about -34°C to  
give non-linear cooling at about 1°C/min. Periodically (at  
each one degree Centigrade drop in temperature starting  
from at least 2°C above the cloud point) the cooled  
oil is tested for its ability to flow through a fine  
15 screen in a prescribed time period using a test device  
which is a pipette to whose lower end is attached an  
inverted funnel which is positioned below the surface  
of the oil to be tested. Stretched across the mouth  
of the funnel is a 350 mesh screen having an area  
20 defined by a 12 millimetre diameter. The periodic  
tests are each initiated by applying a vacuum to the  
upper end of the pipette whereby oil is drawn through  
the screen up into the pipette to a mark indicating 20  
ml of oil. After each successful passage the oil is  
25 returned immediately to the CFPPT tube. The test is  
repeated with each one degree drop in temperature  
until the oil fails to fill the pipette within 60

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1 seconds. This temperature is reported as the CFPP temperature.  
The difference between the CFPP of an additive free fuel and of the same fuel containing additive is reported as the CFPP depression by the additive. A more  
5 effective additive flow improver gives a greater CFPP depression at the same concentration of additive.

Example 12

10 The CFPP performance of Fuel 1 containing various concentrations of the following additives was measured and recorded on the curves of Figure 7.

	Additive	Curve
	(i) Nitrogen Compound A	G
	(ii) EVA Polymer 8 of Table 1	H
	(iii) EVA Polymer 1	I
15	(iv) Polymer 15	J
	(v) 3 Parts Nitrogen Compound A 1 Part EVA Polymer 1	K

Example 13 and 14

20 The evaluations of Example 12 were repeated in Fuels 2 and 3 and the results are recorded in Figures 8 and 9 respectively.

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1 Example 15

The CFFP performance of Fuel 1 containing 50 ppm and 100 ppm of mixtures of different proportions of Nitrogen Compound A and EVA Polymer 1 were determined and recorded 5 on the attached Figure 10.

Examples 16

Example 15 was repeated but using Fuels 2 and 3 and the results are recorded in Figures 11 and 12 respectively.

Example 17

10 The additive combinations of the present invention were evaluated in Fuels 4 and 5 which had the following characteristics

	<u>Fuel 4</u>	<u>Fuel 5</u>
ASTM Cloud Point, °C	-15	-10
Pour Point, °C	-21	-24
WAP, °C	-17.5	-15
Distillation, °C		
Initial Boiling Point	179	158
10%	215	203
20%	230	225
50%	263	269
90%	314	320
Final Boiling Point	345 (98.2%)	347
Residue %	1	1.1

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1 The performance of the additives is evaluated in a test  
developed for the low temperature properties of diesel  
fuels in which a sample of the fuel is brought to the  
test temperature by cooling at 2°F per hour and testing  
5 the filterability at that temperature by determining if  
the fuel will pass through a 350 mesh screen under a vacuum  
of 6 inches of mercury within 60 seconds. If so the fuel  
is considered to PASS.

The ethylene vinyl acetate copolymers used in this Example  
10 had the following structure

TABLE 2

<u>Polymer</u>	<u>MW (VPO)</u>	<u>% VA</u>	<u>Methyl Branching</u>
9	5600	36.2	8.5
10	5000	17	7.5
11	3050	29.4	9.1
12	2775	17.1	8.2
13	2000	36	4
14	1950	29.1	4.6

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- 1 Mixtures of Nitrogen Compound A with varying amounts of ethylene vinyl acetate copolymers 9 to 14 were tested in Fuels 4 and 5, the amount of additive needed to PASS the test being recorded in Figures 13 and 14 respectively.
- 5 The lower the amount of additive showing the better performance of the additive.

The numbers on the curves refer to the number given to the ethylene vinyl acetate copolymer in Table 2 above.

- 10 A Fuel 7 having the following characteristics was used in the next 2 Examples.

	Cloud Point (°C)	-2
	Wax Appearance Point (°C)	-6
	Distillation (ASTM D-86) (°C)	
15	IBP	164
	20	212
	50	262
	90	333
	FBP	370
	Aromatics (% (v/v))	28

- 20 Example 18

Two three cubic metre tanks of the Fuel 7 were cooled under ambient conditions to -14°C and after a cold soak period a 300 ml sample of the fuel was tested for its cold flow performance, as in the DOT. The barrels were 25 then slowly heated to above the WAP of the fuel then

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1 cooled again at 0.5°C/hour to -14°C. The fuel was then pumped out of the barrels through a range of filter screens to determine the finest that the waxy fuel could pass through.

5 The fuel in one barrel contained 135 parts per million of Polymer 15 and only passed a 30 mesh screen whilst the fuel in the other barrel which contained 135 parts per million of a mixture of 4 parts of Nitrogen Compound A and 1 part of EVA Polymer 1 passed a 100 mesh screen.

10 Example 19

In this example, the results are from four 25 m<sup>3</sup> tanks of Fuel 7 which were tested side by side. Over a period of three weeks storage, under natural cold conditions (including natural temperature cycling), the fuel at -14°C 15 was pumped out of the tanks as in a fuel distribution situation - and the finest filter screen that the fuel would flow through was recorded as follows

	Treat Rate P.P.M.	Additive	Mesh Passed
20	70	Polymer 15	30
	70	4 Parts Nitrogen Compound A 1 Part EVA Polymer 1	40
	135	Polymer 15	30
	135	4 Parts Nitrogen Compound A 1 Part EVA Polymer 1	100

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